Research on the Core Technology and Application Prospect of Cloud Computing

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Abstract

Cloud computing as the backing, to the Internet resource sharing, service mode innovation is characterized by value, SaaS, PaaS, IaaS three platform layer system and five core technology, analyzes the application prospect of cloud computing from the social information level, industrial transformation and upgrading, development, the small and medium-sized enterprise software and information technology cloud services, industrial chain in five aspects. Finally, the distributed computing industry chain company through the clouds, the application prospect of the development process and the challenges of cloud computing in the cloud computing makes preliminary study.

Keywords

Cloud computing; core technology; application prospect.

1. Introduction

In October 2008, Cloud Computing (Cloud Computing) is a famous American in the information industry research and consulting firm Gartner included in the list of top ten strategic technology ", after four years in a row of Cloud Computing is famous on this list, in 2009 and 2009, Cloud Computing is at the top. Cloud computing has been a hot topic since then, and cloud computing has unleashed a wave of change in the IT technology system with a sweeping global vigor [1]。

Cloud computing users can like water and electricity, the concept of on-demand access to various resources, is the earliest McCarthy (John McCarthy) [2] in the 1960 s, after the grid computing, utility computing, and virtualization technology such as different stages of technology development. There may be dozens of interpretations of cloud computing. According to the national institute of standards and technology (NIST) [3], the definition of cloud computing is a use of the Internet anytime, anywhere, on demand, easy access to a Shared resource pool (such as computing facilities, storage devices, applications, and so on) of the computing model. Although the NIST think cloud computing is a kind of access to resources through the network mode, IBM said cloud computing is a model of IT resources to provide, Google believe that cloud computing is to provide network resources. Regardless of how these definitions are described, 90% mentions that cloud computing is a service.

2. The core of cloud computing

Throughout the various definitions of industry of cloud computing, and really can be said to be different, but after thorough analysis found that the core of each definition is almost the same, in the aggregate, and basically has the following three aspects.

2.1 The Internet must be relied on

The development of cloud computing must be based on the Internet, which is the most basic environment of the architecture cloud computing platform. NIST, Google, HP, baidu encyclopedia,

interactive encyclopedia Wikipedia, Berkeley university to the definition of cloud computing, all think of cloud computing, cloud services must be based on network, Internet, highlights the importance of network and communication in cloud computing. Major telecom operators and network companies have seen the development the important role of network in the cloud, so they also positively to change, for those routes, and in offering a variety of communications, network services at the same time, to the cloud service transformation.

2.2 The core feature is resource sharing

Core characteristics of cloud computing is to make all kinds of physical and virtual resources, including computing, storage, hardware, software and application, network, system, environment, etc.) Together, and share resources of pooling via the Internet and use it. This is a kind of innovation that is not only a kind of business, but also a service model. NIST, Google, Microsoft (Microsoft), baidu encyclopedia, interactive encyclopedia, Wikipedia, and Cisco (Cisco) to the definition of cloud computing, mentioned the core characteristics of "resource sharing".

2.3 Its core value is the service model innovation

The core value of cloud computing is the innovation of service patterns, which is a pattern of "all services" (see figure 1).

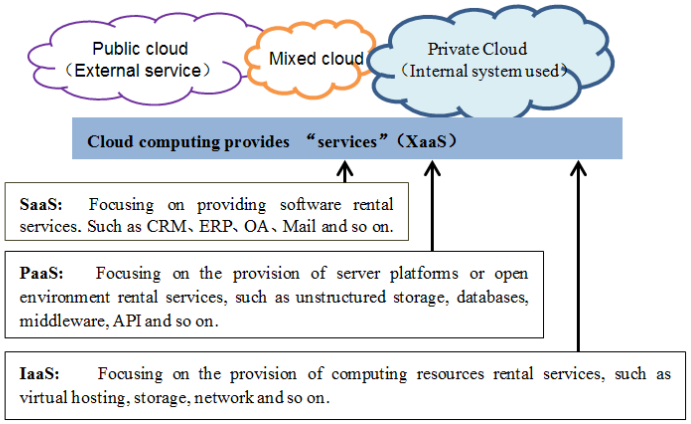

Figure 1 cloud computing "all service" models

3. Cloud computing architecture and core technologies

3.1 Architecture of cloud computing

Cloud computing service platform is applied to the technology, on the surface can be a bit complicated, but if the cloud computing system, analyzing its architecture system is clearly visible, the architecture of cloud computing system is mainly composed of "service" and "management" two parts.

（1）Cloud computing services layer includes SaaS, PaaS, and IaaS platforms. SaaS is a Service called Software as a Service (software-as-a-service), which is used primarily to provide users with various application services over the Internet. PaaS is short for Platform as a Service (Platform as a Service), which mainly serves as a Service to users of application development and deployment. (3) is IaaS Infrastructure as a Service (hereinafter referred to as Infrastructure as a Service), the main role is the most basic computing, storage, and hardware pooling resources as a Service provided to the user. Cloud providers all the software and hardware facilities, are unified in the "cloud" layer, the user can not only on-demand usage anytime and anywhere, and the biggest advantage is that users don't have bothers about software upgrades, hardware maintenance, etc.

（2）The management of cloud computing is divided into three levels: user layer, mechanism layer and test layer. The main task and function of cloud computing management is to allow the entire cloud computing center to be safely and effectively run. ⓑ the user layer is the cloud user oriented management functions, including user management, customer support, service management and

billing management four modules, and through the management of the four modules to provide users with high-quality services; ② mechanism is mainly to the overall deployment of the clouds and effective operations, including operations management, resource management, security management and disaster support four modules, and through the perfection of the four modules let cloud computing center have safer, greener and more automated management; ③ detection layer is mainly responsible for all aspects of cloud computing center detection and monitoring, including physical resources, virtual resource layer, application layer three levels, its function is mainly to collect all kinds of related data, for the user in the cloud management layer as well as the mechanism to use. Although familiar with cloud computing management and can effectively manage the person very few, but this is the core part of cloud computing, this part is like a company's board of directors, the number of people in a small, but each is a crucial key person.

3.2 The core technologies of cloud computing

Cloud computing systems use a lot of technology, of which virtualization technology, huge amounts of data storage technology, massive data management technology, the MAP - Reduce programming model, cloud computing platform management technology and so on five big content is the most crucial [4].

(1) Virtualization technology, it is to integrate all kinds of computing and storage resources fully and the key technology of efficient utilization, and cloud computing, cloud storage service to realize the core technology. Virtualization technology is mainly divided into platform virtualization, resource virtualization, and application virtualization. Platform virtualization of major computers and operating systems; Resource virtualization is primarily the virtualization of system resources such as memory, storage, and network. Application virtualization includes simulation, simulation, interpretation, etc. The virtualization of the cloud resource is not fixed tangible entity, even in the case of software applications from the underlying hardware, virtualization technology can also be through the splitting pattern to a single resource is divided into multiple virtual resources, or through the aggregation mode joint multiple resources into a virtual resources.

(2) Huge amounts of data storage technology, namely with the method of distributed storage to store data, adopt the way of redundant storage to ensure the reliability of data storage, which is the same data store multiple copies. This technology is not only highly available, reliable and economical, but also serves a large number of users at the same time. Traditional database technology is facing severe challenge, especially in huge amounts of data has been growing, so you have to build a new high throughput, high rate of cloud database to cope with the huge amounts of data.

(3) Mass data management technology, the biggest characteristic of cloud computing is a must for their store huge amounts of data, reading, processing and analysis on a large scale, especially the frequency of the read operation is very high, so the cloud computing is the essence of the mass data management is a kind of read optimized data management model. Finding specific target data in the shortest possible time in a large data cluster is a technical challenge for large data management. Currently, Google's Big Table data management technology represents the core technology of cloud computing's vast data management system. Because BT data management technology USES a column storage approach, the accuracy of reading target data on a large amount of data is very high.

(4) The MAP - Reduce programming model, that is, through the MAP (shot) down and Reduce (reduction) of the theory and method will execute the problem of decomposition, the MAP program task is to cut the data block type, then the scheduling or assigned to a large number of computer to the corresponding data processing, Reduce program task is received the distributed computing and summarize the result output. Because the MAP - Reduce which have many advantages, such as strict, good, practical cloud users can enjoy more simple and easy to use and convenient service, so now the programming model used by almost all IT vendors, basically have the MAP - Reduce shadow.

(5) Cloud computing platform management technology. The most critical problem to be solved is how to make many servers can work together, with the most convenient way for various business

deployment, with the fastest speed and fault recovery system, by means of intelligent, automated and the large scale system to get the most reliable operation.

4. Cloud computing application outlook analysis

In recent years, digital city, network education, network media, search engine, e-commerce, e-government, online video, industrial application, subject, application of a new generation of large scale Internet application development is very rapid, the biggest characteristics is large data storage capacity, fast growth, high maintenance costs. This for traditional IT industry, these are a lot of difficulties, but for cloud computing, these are the best opportunities, IT also shows that the cloud computing just wide application prospect. In 2006, according to IDC, International Data Corporation International Data corp.) Statistics of 200 companies, part of the enterprise information technology the human cost of $1320 / per person/per server, and deploy a new application system takes 5.4 weeks [5]. With the development and maturity of cloud computing, and the huge amount of storage data, the problem of high maintenance costs will be solved.

4.1 Cloud computing can promote the rapid improvement of social information

(1) Cloud computing can promote the computer hardware and software, network resources, information infrastructure construction, to lower costs and better management skills, cracking the government, enterprises, and other units facing the ops, such problems as high cost and large energy consumption, so as to promote the social information level to a higher level by leaps.

(2) The cloud computing can effectively integrate the electronic government affairs, health, social security, etc. In the field of public information resources, to better promote social and public services, the level and efficiency of the government public relations services, etc. [6].

(3) Cloud computing is a powerful data storage and management technology, not only provide solid foundation for scientific and technological innovation, and promote enterprise's technological innovation ability greatly, the PaaS rapid deployment of the service mode, you can also shorten the cycle of service and products into the market, improve the dynamics of the user's information and various business agility.

(4) Cloud computing can not only improve the efficiency of equipment operation, extend the time limit of hardware, but also can reduce energy consumption and operating cost, energy saving effect is remarkable, very well reflected the national policy of energy conservation and emission reduction and green development direction.

4.2 Cloud computing facilitates the transformation and upgrading of software and information technology services

(1) Cloud computing subversive influence on the traditional software industry, users needs hardware and software, network, computing and storage resources can be provided directly by the cloud computing data center. So, in the cloud computing service innovation mode user as long as pay, you can get to all kinds of application software, the current replication such piracy will also cease to exist.

(2) Cloud computing for information technology services will also be a disruptive impact, with the development of virtualization technology and mature, all the pooling of resources will be concentrated in the "cloud" side, the user can need not to purchase and upgrade hardware and software, as long as the rent way according to the need to use it[7].

So, information technology services and service methods also become very simple, as long as through the cloud platform of large cloud data center operators, can provide users with paid software, hardware, network, computing, storage and other services.

4.3 The cloud computing industry chain presents a broad application prospect

At present, with the core of cloud service providers, network providers, for the government, the small and medium-sized enterprises, public user, internal users of cloud computing industry chain, are gradually formed. In the industrial chain is mainly composed of terminal providers, system integrators,

application developers, platform providers, hardware developers, solution providers, operational services and so on seven big links.

(1) At the core level, cloud service providers are the new modes of service pioneered by the cloud computing SaaS, PaaS, and IaaS. Internet providers are companies that provide Internet services such as China telecom, China Unicom and China mobile.

(2) At the user level, the government functions mainly to formulate relevant policies and regulations to guide and promote the healthy and rapid development of the cloud computing industry. Small and medium-sized enterprises have become a major player in China's economic development. Public users are existing, potentially, individuals, groups or organizations that exist in the cloud; Internal users refer to the customers of various suppliers in government, enterprises and industrial chains.

(3) At the seventh level, the end providers mainly include terminals and terminals, which are increasingly prominent in the industrial chain. System integrators are the software and hardware platform of cloud computing for users. Application developers mainly refer to the SaaS application service provider, whose function is to present various applications to a large number of users. Platform providers are the manufacturers of hardware and software development and deployment of PaaS platforms. Hardware providers are mainly hardware makers; The solution provider refers to the intelligence service that provides the solution to the user. The main function of the service provider is to provide various services to the user based on the service-level agreement.

Our country "Beijing" xiangyun project "action plan" put forward in 2015, the three kinds of typical service of "cloud computing" -- infrastructure services, platform service and software service form 50 billion yuan of industrial scale, thus promoting cloud computing industry chain form 200 billion yuan output value [8].

5. Application of cloud computing applications

5.1 Through the distribution of cloud computing companies, the application prospect is seen

From the industrial distribution of domestic and foreign famous cloud computing company, they formed by cloud computing services provided by the cloud computing industry and have distinguishing feature each, each has his strong point, each have their own market competitive advantage.

According to statistical analysis, IBM and HP are focused on hardware and IaaS, and Microsoft and Google are focused on SaaS and PaaS, such as Microsoft's Windows and Office, Google's search, Earth, Gmail, and so on. The domestic cloud computing companies mainly provide IaaS, with only a small amount of SaaS. Thus, all the blank Spaces in the table are the most promising areas for cloud computing.

5.2 The challenge from the development of cloud computing is to look at its application prospects

Although cloud computing has many advantages, cloud computing still has a lot of practical problems that need to be solved and the gap that has not yet been developed. One of the most challenging issues in the development of cloud computing is the most promising area of cloud computing applications. Each of the problems in table 1 indicates a clear direction for future development of cloud computing.

Table 1 cloud computing challenges and their application prospects

Number	Challenging problem	The main content of the problem is described	Application prospects and development opportunities
1	Data sovereignty, security, and auditability	Data storage, transmission security, data privacy, data, the sovereign and the authentication enterprise survival and development of commercial confidentiality and data security issues, is bound to affect the application of cloud computing in the enterprise.	Improved encryption technology; VLANs and firewall; Data storage across geographies

2	Bottleneck of network data transfer	Cloud computing services are all dependent on the Internet, and the speed of cloud computing is not yet stable enough to make the performance of cloud applications much worse.	Fast disk; Data backup acquisition; Lower wan routing overhead; Higher bandwidth LAN switches.
3	Data privacy and legal crises	How to ensure that data privacy in the cloud service provider is not illegal and requires technical improvement as well as legal progress.	Adopt specific services and laws for effective legislation and protection.
4	Data lock	The cloud API is still no unified standard, user is difficult to put their data and programs from one site to another, it is also a lot of users are reluctant to adopt cloud computing.	The standard API is used to bind the price and the quality of the service
5	Technical standards and operational standards	Lack of unified technical standards and operational standards, such as the data interface, data migration, data exchange, test and evaluation, etc., and such as SLA., cloud computing management and main meter, operational norms, accounting standards, etc., is not conducive to the user's unified understanding and the large-scale promotion of cloud services.	The relevant standardization organizations shall formulate the industry technical standards and the operating standards
6	Availability of services	Many users worry that utility computing services provide good usability, and there are doubts about cloud computing.	Use multiple cloud computing providers; Use elasticity to prevent DDOS attacks
7	Performance unpredictable	Multi-virtual machines in cloud computing can share CPU and memory very well, but I/O sharing is problematic.	Improved virtual machine support; Flash memory; Virtual clusters that support HPC applications
8	Scalable storage and quick remontable scalability	Short periods, without the cost of upfront costs, and the need to provide unlimited resources on demand, how to apply for a persistent storage is a problem that cannot be ignored. The out-of-the-box is certainly good for storage and network bandwidth, both of which can be measured in bytes.	Inventing scalable storage; Machine learning based on automatic scaling; Use snapshot techniques to save resources
9	Software license	Current software license usually is limited to run software on the machine, the user to buy software and according to the annual maintenance fee, many cloud computing providers tend to open source software, from the beginning part of the reason is the commercial software license model is not suitable for utility computing.	Use the out-of-the-box license; Bulk sales.
10	Usage of the user	How to change the user's usage habits, the user ADAPTS to the network of hardware and software application is a long-term and arduous challenge	Easy to use, reduce the cost of using, and expand publicity.

6. Conclusion

So, although the challenge for the cloud computing is very severe, 10 aspects of the above listed a series of problems, are just currently encountered major aspects. However, the more problems there are, the more challenging it will be, the better it will be for the application and development opportunities of cloud computing.

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